

Connectivity of Tributary Habitat to Lake Huron

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Overall objective

“Over the next two decades, restore an ecologically balanced fish community dominated by top predators and consisting largely of self-sustaining indigenous and naturalized species ...”

Source: Fish-Community Objectives for Lake Huron (1995)

Migrations have been described for at least 61 of 114 fishes in the Great Lakes region

Examples

Alewife	Dace, blacknose	Muskellunge	Shiner, striped
Bass, largemouth	Darter, blackside	Northern pike	Smelt, rainbow
Bass, rock	Darter, iowa	Pickrel, grass	Stickleback, brook
Bass, smallmouth	Darter, least	Quillback	Sturgeon, lake
Bass, white	Drum, freshwater	Redhorse, black	Sucker, longnose
Buffalo, bigmouth	Eel, American	Redhorse, golden	Sucker, northern hog
Buffalo, black	Gar, longnose	Redhorse, river	Sucker, white
Bullhead, yellow	Herring, lake	Redhorse, shorthead	Trout, brook
Burbot	Lamprey, American brook	Salmon, chinook	Trout, brown
Carp, common	Lamprey, northern brook	Salmon, coho	Trout, lake
Catfish, channel	Lamprey, sea	Salmon, pink	Trout, rainbow
Chub, creek	Lamprey, silver	Shad, gizzard	Trout-perch
Chub, lake	Minnow, brassy	Shiner, pugnose	Walleye
Chub, silver	Mooneye	Shiner, spottail	Whitefish, round
Chubsucker, creek	Mudminnow, central		

Sources: Becker (1983); Trautman (1981); Scott and Crossman (1973)

Lake Huron Drainage Basin



Inland habitats available to fishes



Then



Now

Fish-Community Objectives for Lake Huron

Highlights

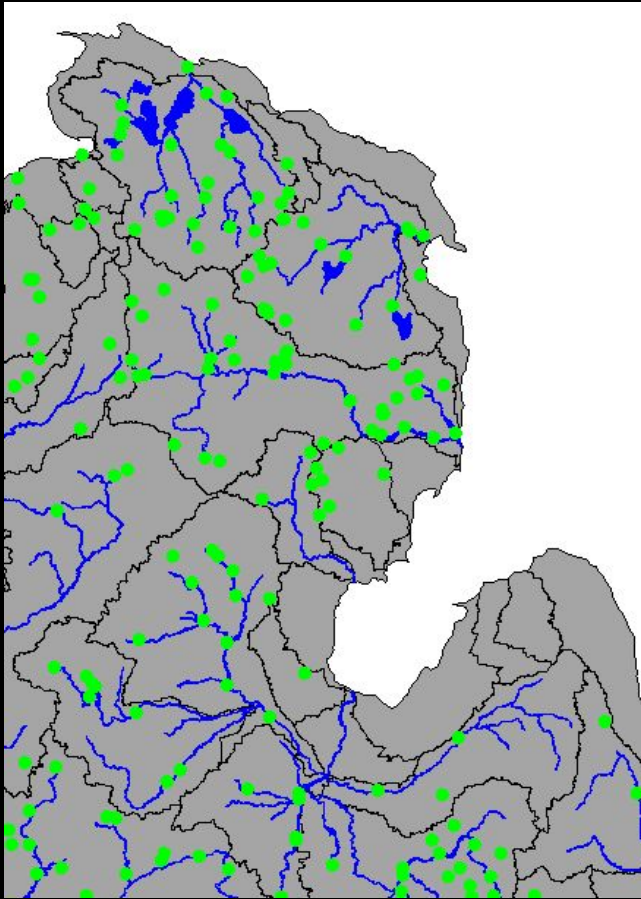
- Salmonines- “Anadromous (stream-spawning) species should have a prominent place.”
- Percids- Saginaw Bay and eastern Georgian Bay walleye stocks “have suffered from environmental degradation or from overfishing and require rehabilitation.”
- Esocids- “preservation and enhancement of spawning and nursery habitat will be critical” for maintaining populations

Fish-Community Objectives for Lake Huron

Highlights

- Lake sturgeon- Lake Huron population was “..aggravated by damming of larger rivers, which provided spawning and nursery habitat.”
- Species diversity- protect and rehabilitate habitat
- “..stocking of fish must not be regarded as a substitute for nurturing natural populations and care of habitat.”
- Habitat manipulation options are usually limited to nearshore environments and tributary streams.

Dams alter river functions and the Lake Huron fish community



Major dam locations

- Dams impound highest-gradient rapids and block migrations of Lake Huron fishes to existing rapids further upstream. Taxa affected include trout, salmon, lake sturgeon, whitefish, walleye.
- Dams disrupt sediment transport needed to maintain delta wetlands at river mouths. Species affected include yellow perch, northern pike, muskellunge.

What can we do?

- Develop decision support tools
- Use them to target effort and build consensus



Without dams



With dams

Our basin-level “toolbox” is presently limited

Lake Huron GIS Project will help

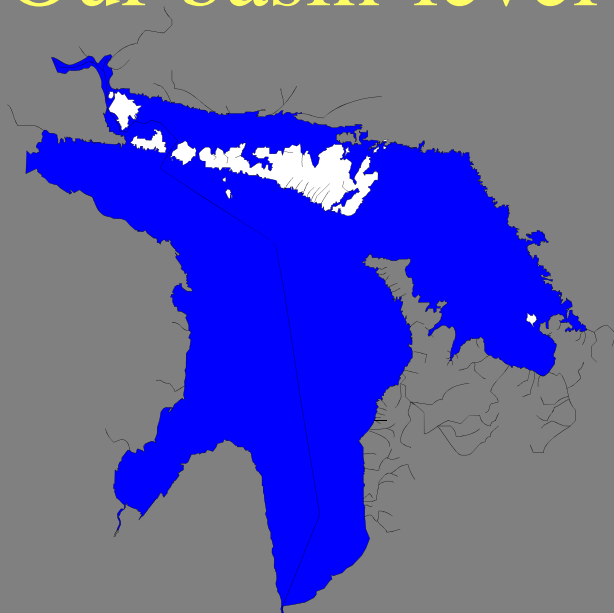
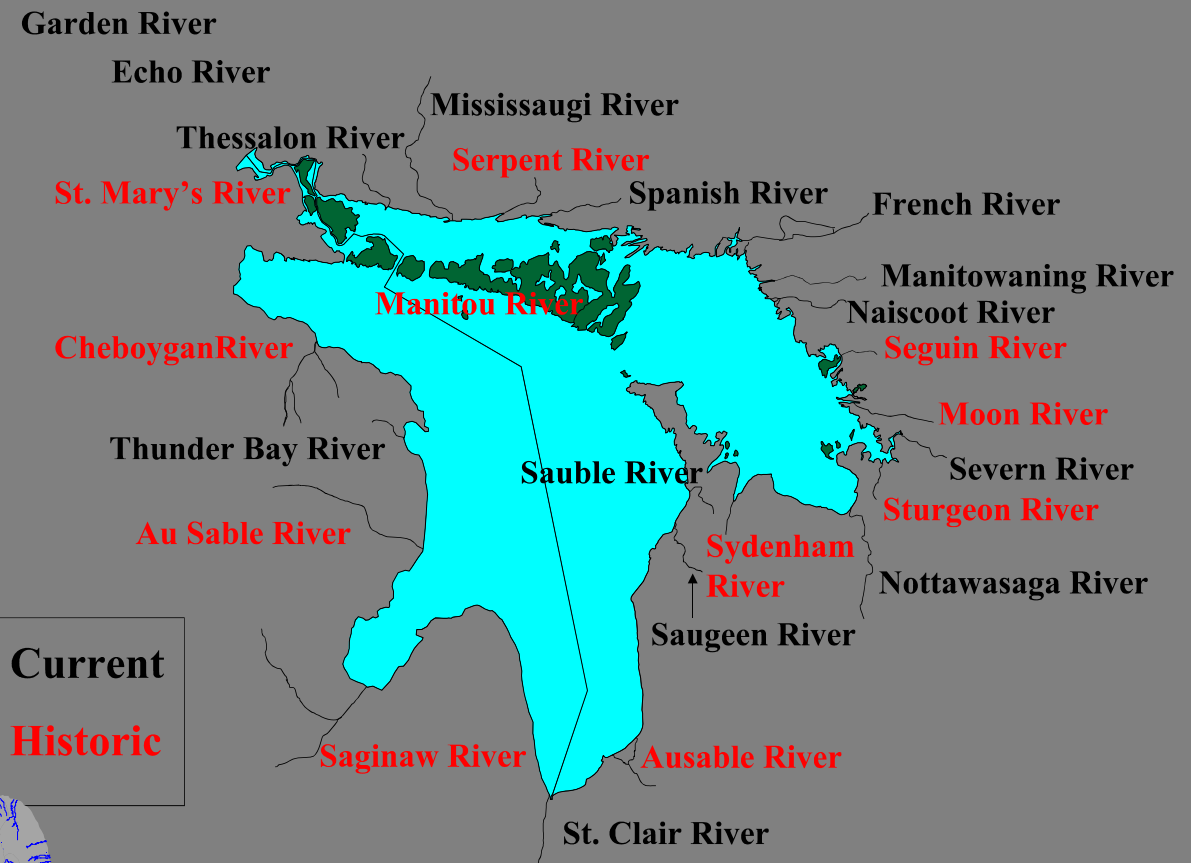
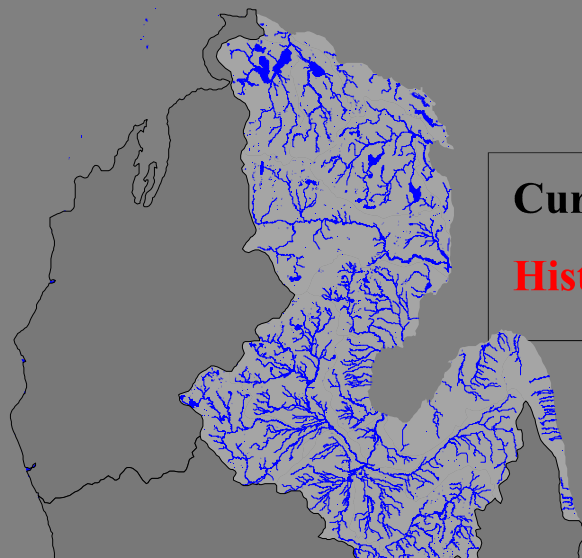


Fig. 2 Locations of rivers with rainbow trout runs in the Lake Huron basin.



What else can we do?

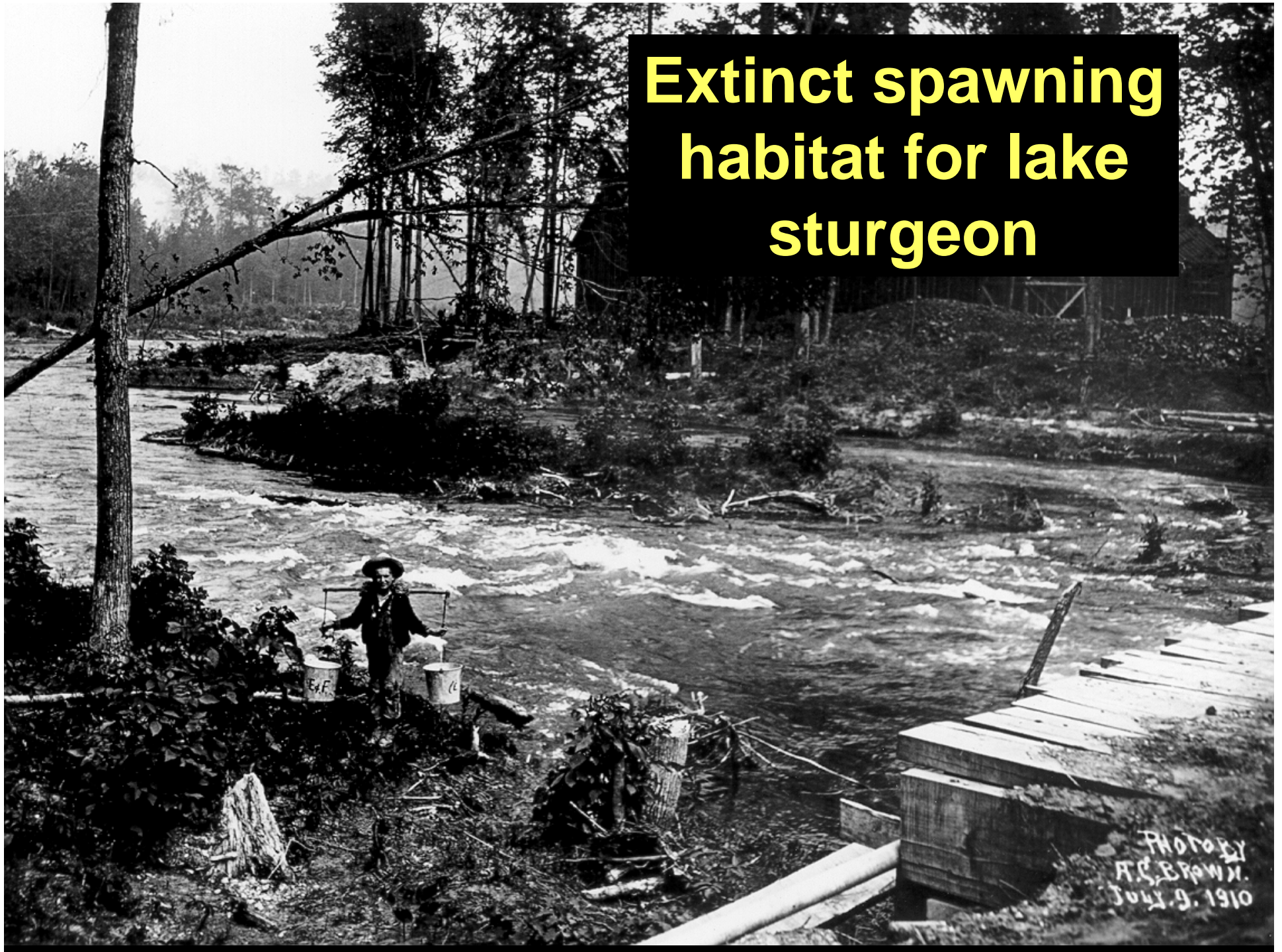
Be opportunistic in regards to fish passage and dam removal

- Provide incentives for dam-owners considering these options
- Take advantage of existing opportunities

Lake Sturgeon Objective: To increase the species' abundance to the extent that it no longer has threatened status in U.S. waters .



Extinct spawning habitat for lake sturgeon



Lake Sturgeon Potential

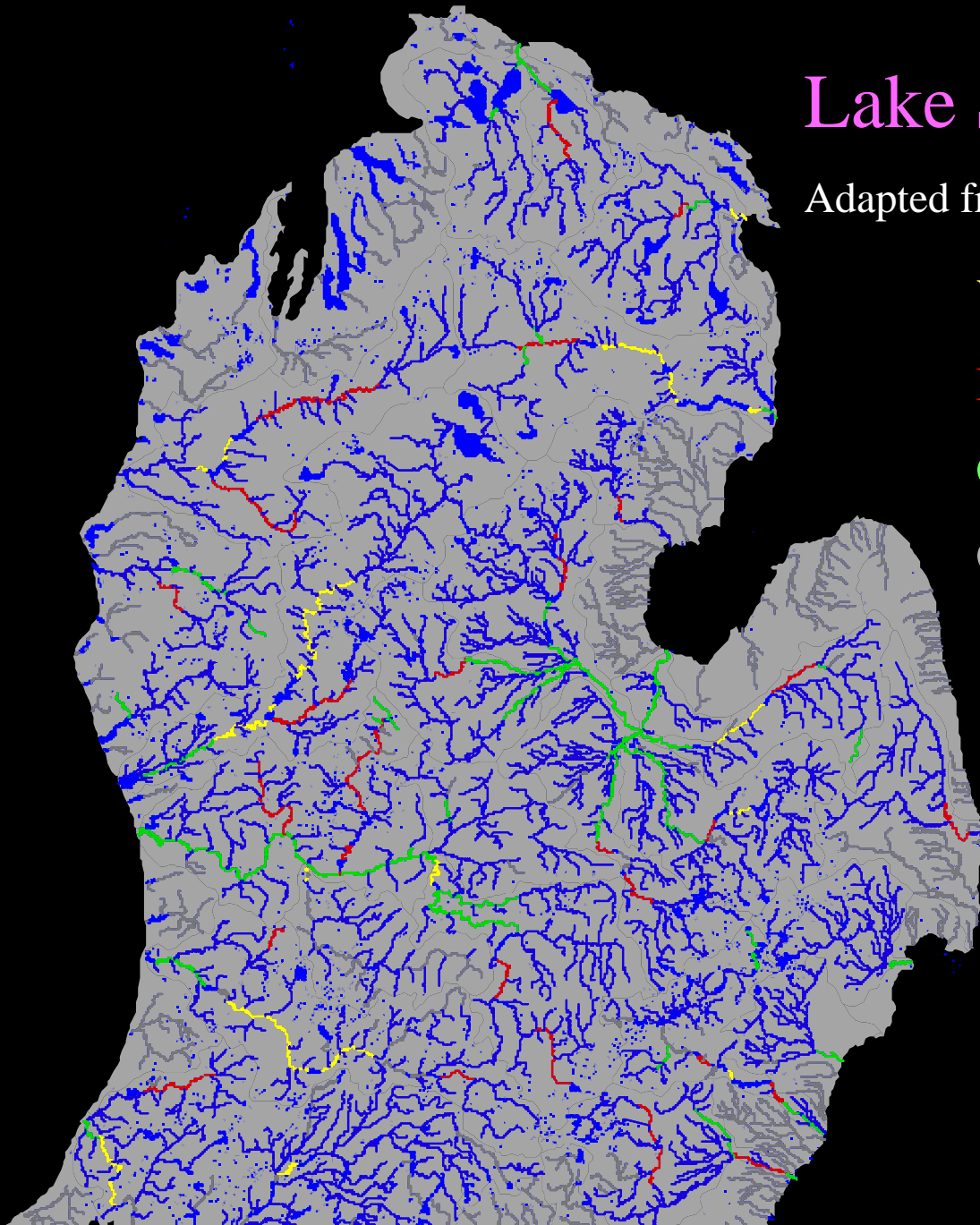
Adapted from Seelbach et al. (1997)

Yellow = High

Red = Medium

Green = Low

Gray = No data



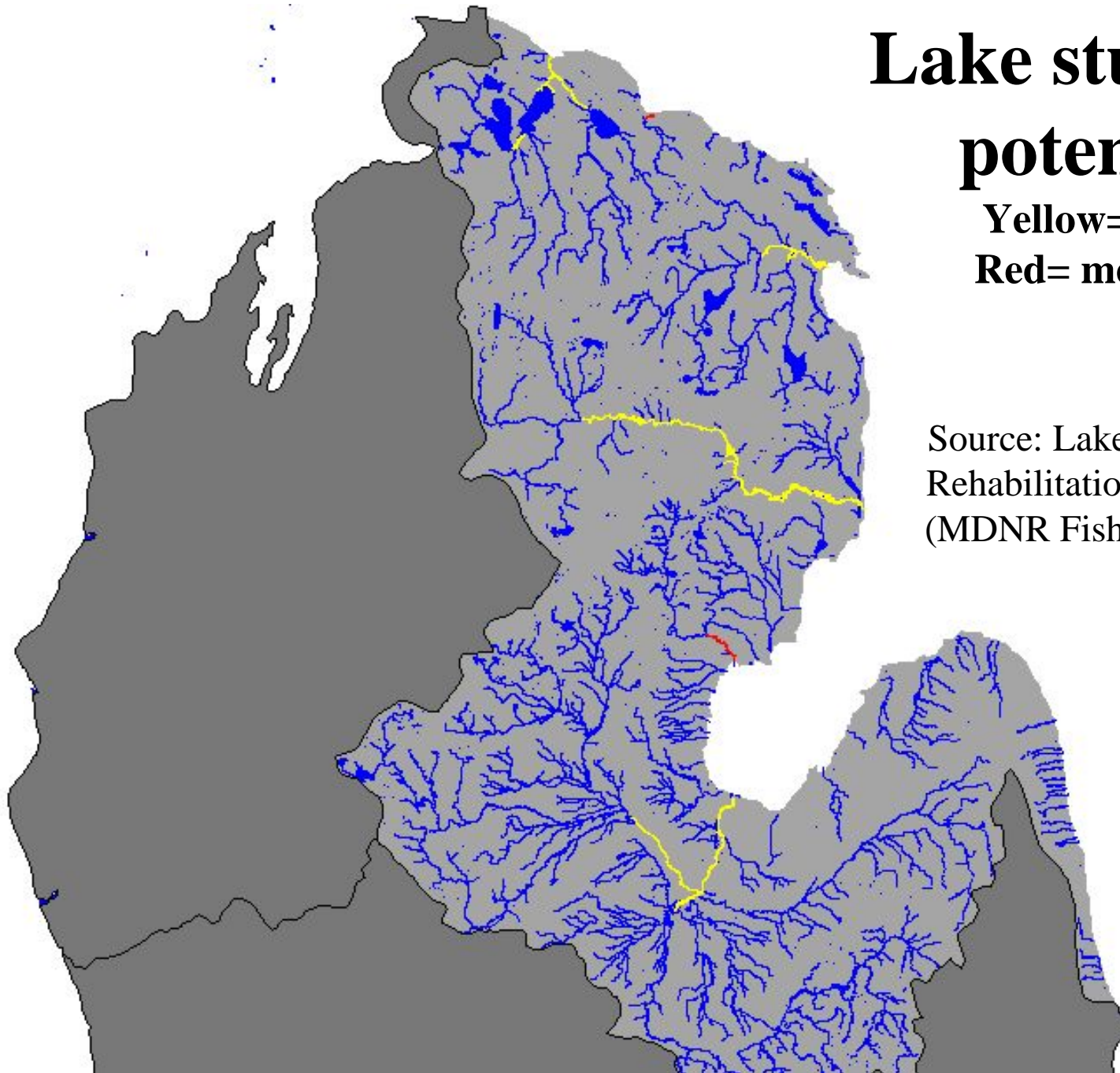
See notes

Lake sturgeon potential

Yellow= high

Red= medium

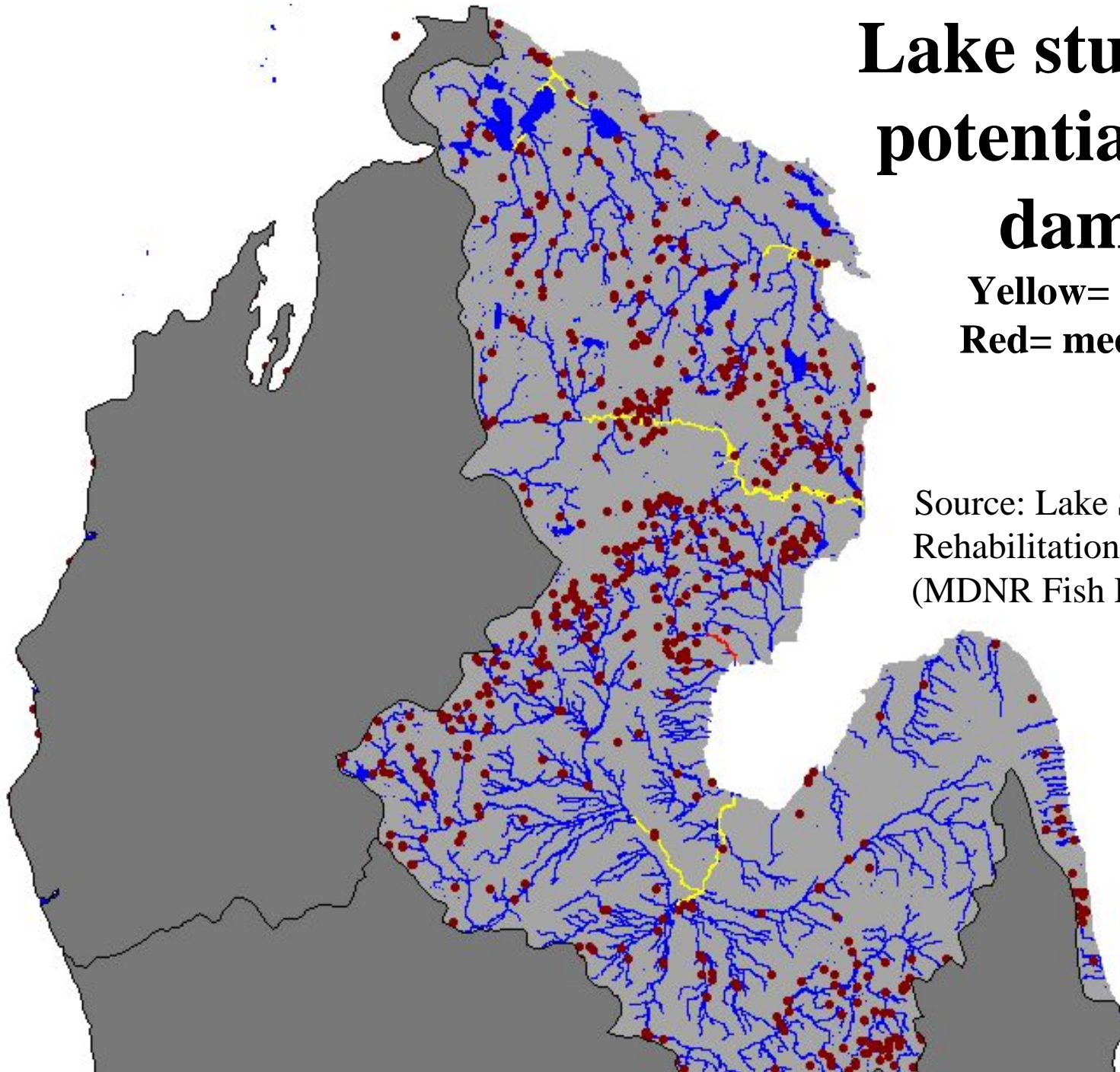
Source: Lake Sturgeon
Rehabilitation Strategy
(MDNR Fish Division)



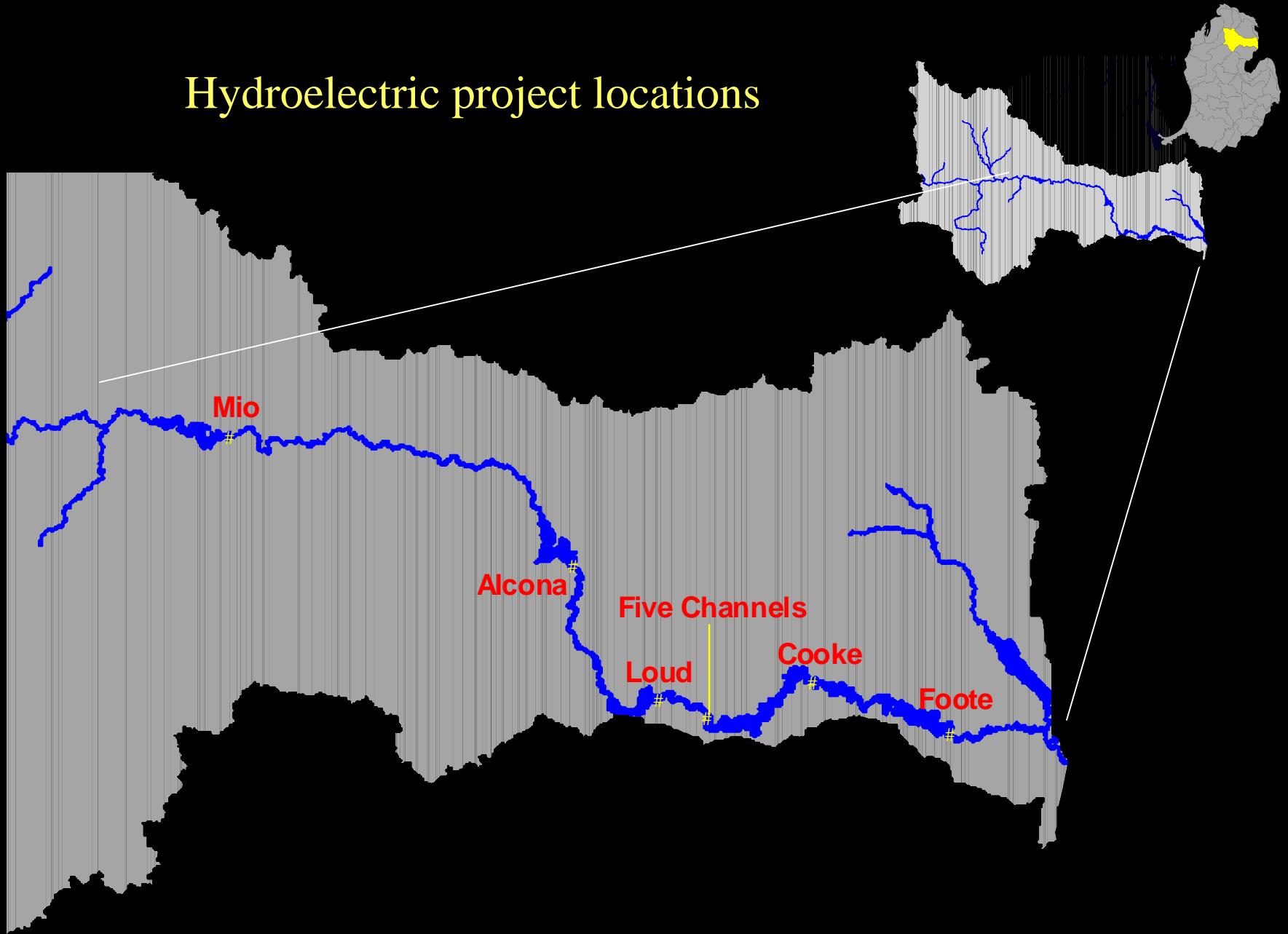
Lake sturgeon potential and dams

Yellow= high
Red= medium

Source: Lake Sturgeon
Rehabilitation Strategy
(MDNR Fish Division)

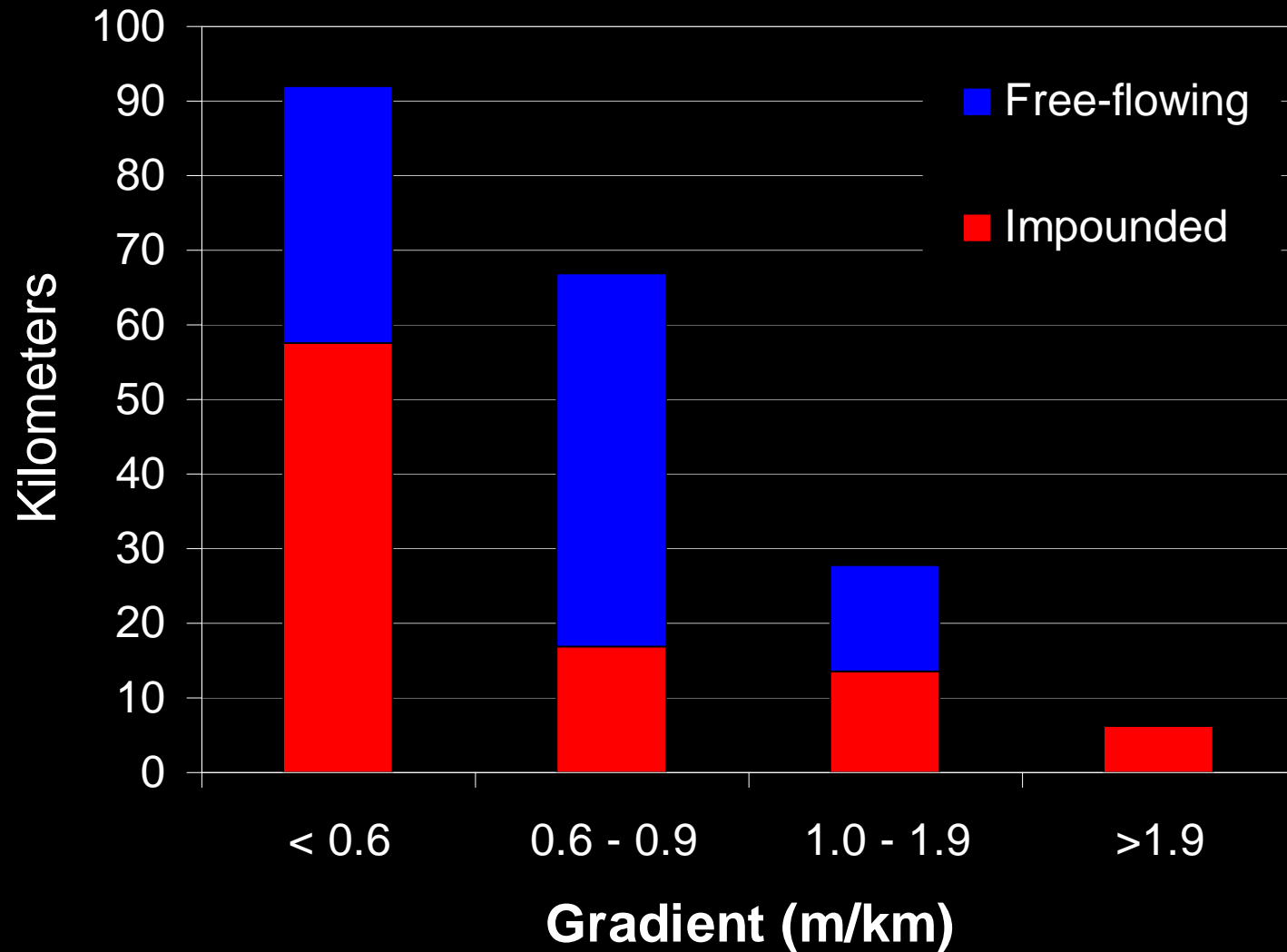


Hydroelectric project locations



Au Sable River Gradient Distribution

from South Branch Au Sable River to river mouth



Biological potential of **existing** high-gradient habitats between Mio and Foote dams for Lake Huron fishes

Adult lake sturgeon run

- 12.2 km of >0.95 m/km x 1,180 fish per km = **14,440 fish**

June young-of-year chinook salmon

- 18.8 km of >0.87 m/km x 551,195 fish per km = **10,382,360 fish**

September young-of-year steelhead

- 18.8 km of >0.87 m/km x 15,443 fish per km = **290,908 fish**

Michigan's Golden Opportunity: Consumers Energy has agreed to provide for design, construction, operation, and maintenance of fish passage facilities on the Au Sable River.

...IF



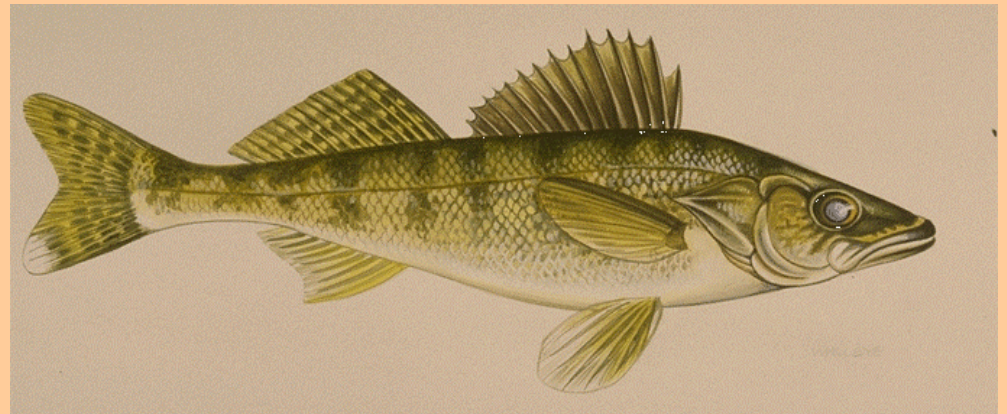
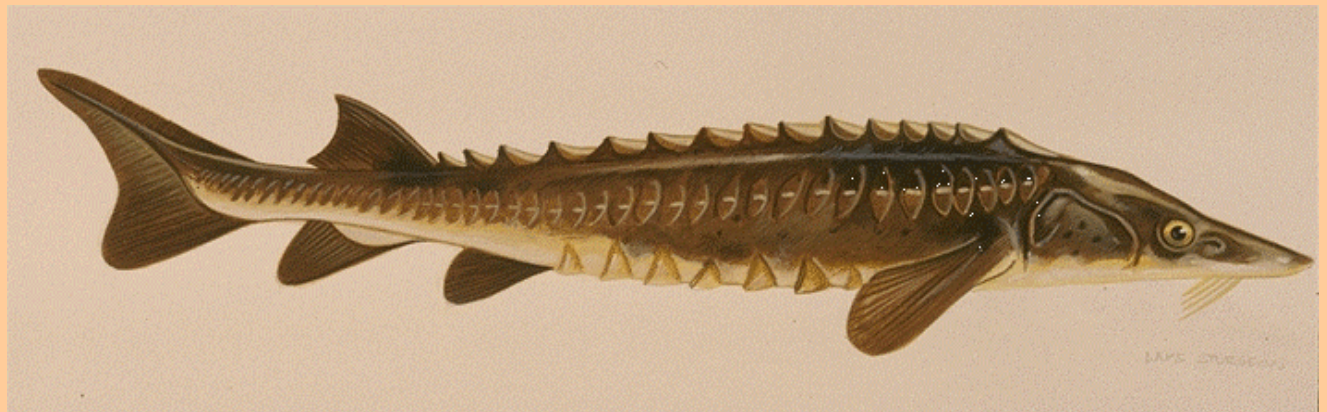
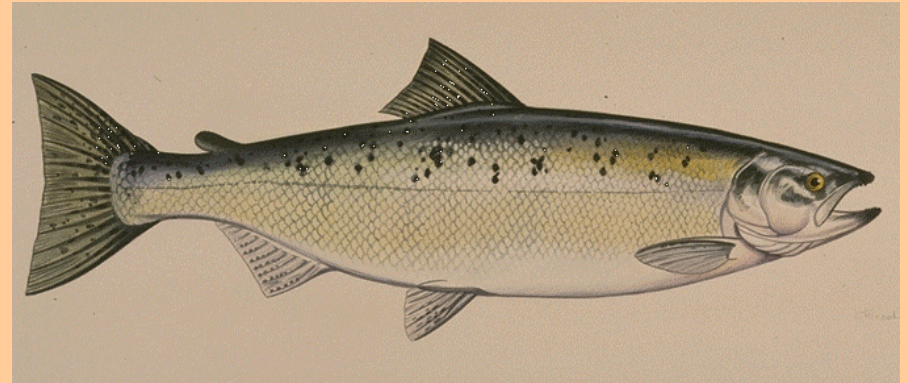
Source: Settlement Agreement (1992)

...agencies and public can agree on how it should be done.



Fish Passage Concerns

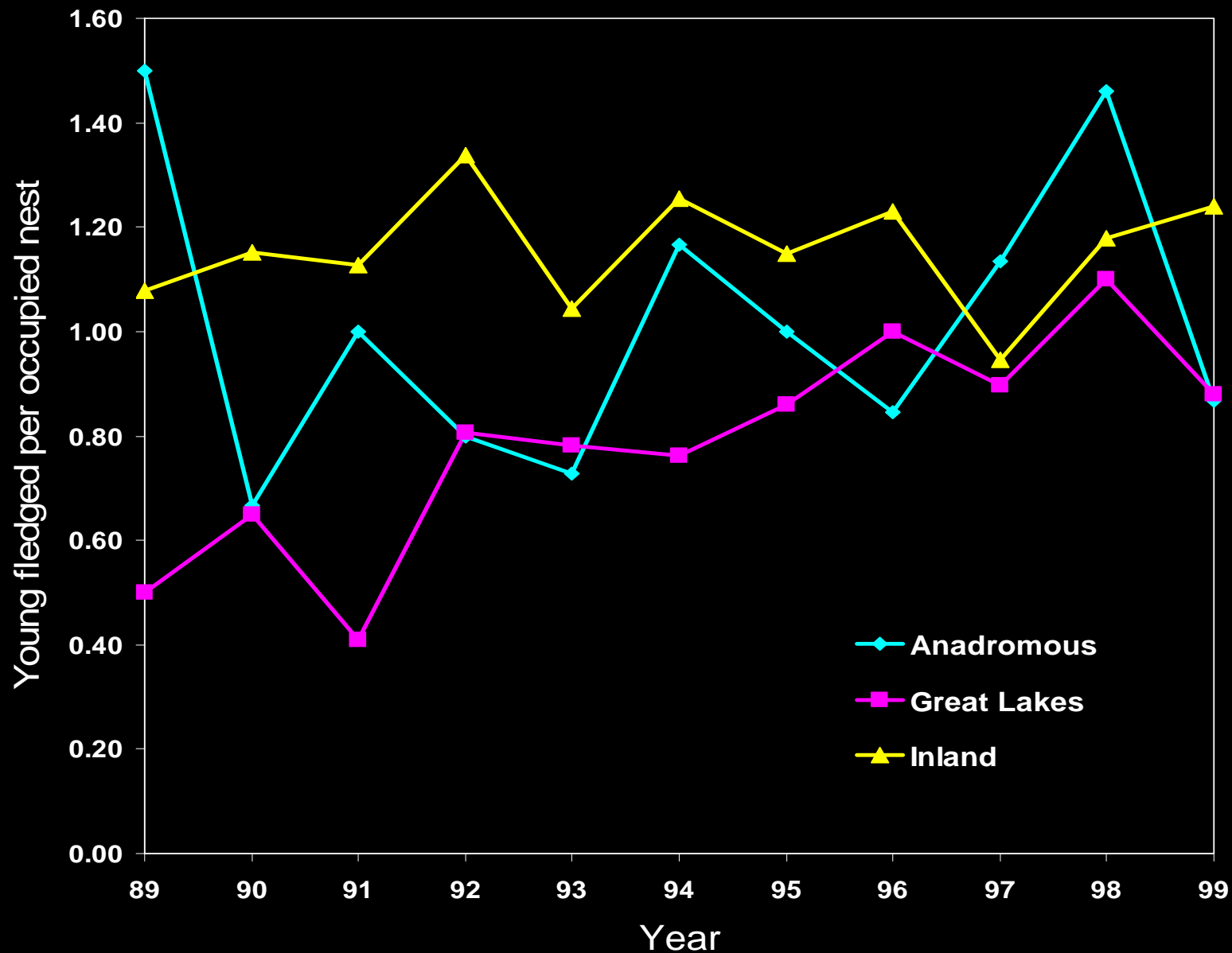
- Contaminants



Art credit: Department of Fisheries and Oceans

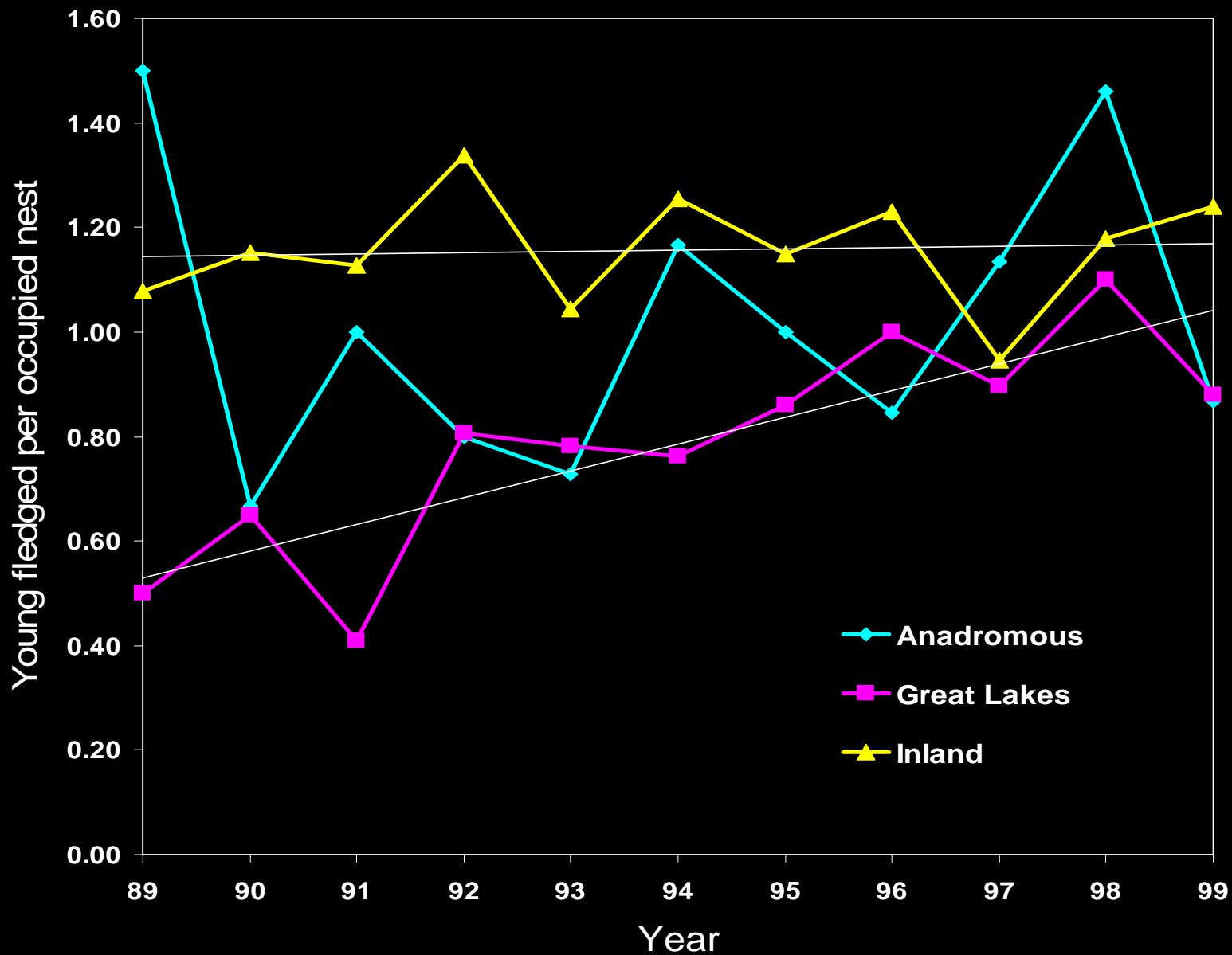
Productivity of bald eagles in the Lower Peninsula

Source: D. Best, USFWS, 2000



Productivity of bald eagles in the Lower Peninsula

Source: D. Best, USFWS, 2000



Average number of bald eagles fledged per nest type in Michigan's Lower Peninsula

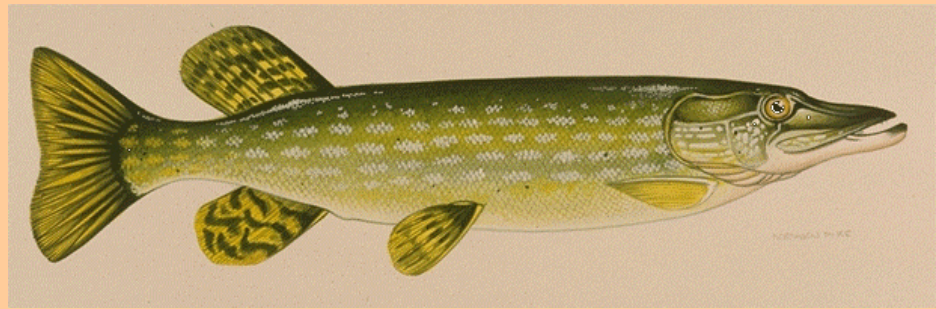
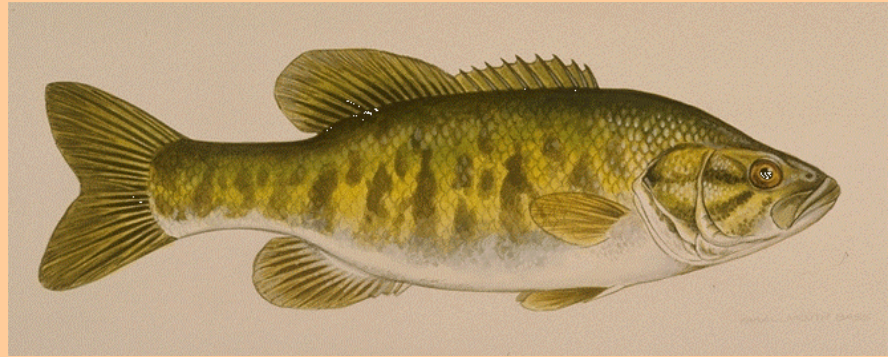
Source: D. Best, USFWS, 2000

<u>Nest type</u>	<u>1995-9</u>
Inland	1.15
Anadromous	1.06
Great Lakes	0.95

0.7 = Stable and 1.0 = Healthy (Sprunt et al. 1973)

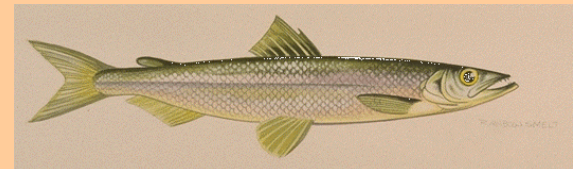
Fish Passage Concerns

- Contaminants
- Social issues



Possible solutions

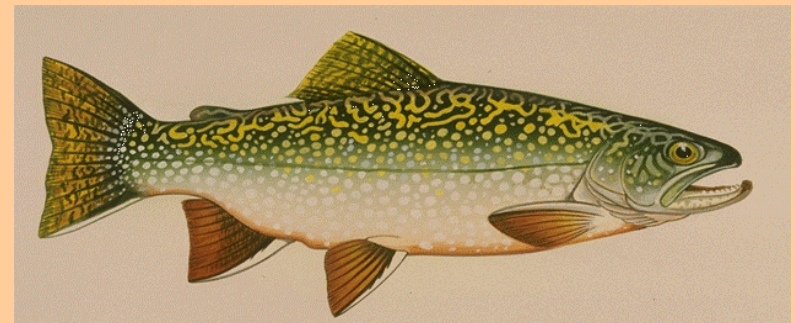
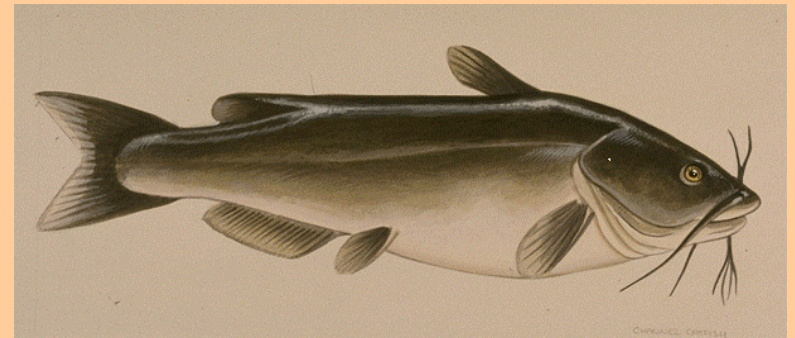
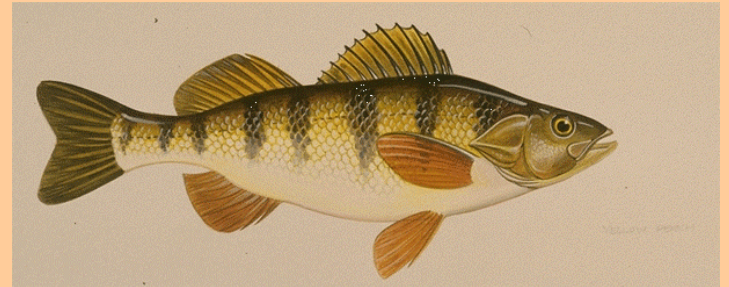
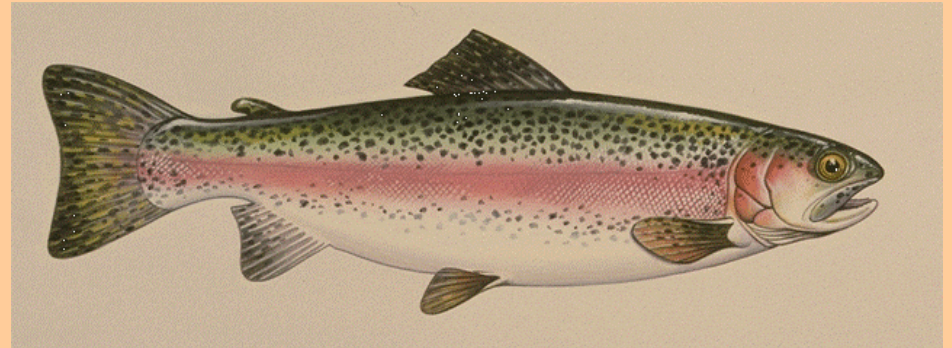
- Monitor wildlife
- Limit salmon runs
- Close ladders in Fall
- Regulate salmon fishery upstream of dams



Art credit: Department of Fisheries and Oceans

Fish Passage Concerns

- Contaminants
- Social issues
- Sea lamprey



Possible solutions

- Monitor wildlife
- Limit salmon runs
- Close ladders in Fall
- Manage sea lamprey

Art credit: Department of Fisheries and Oceans

Fish Passage Concerns

- Potential competition with wild trout stocks



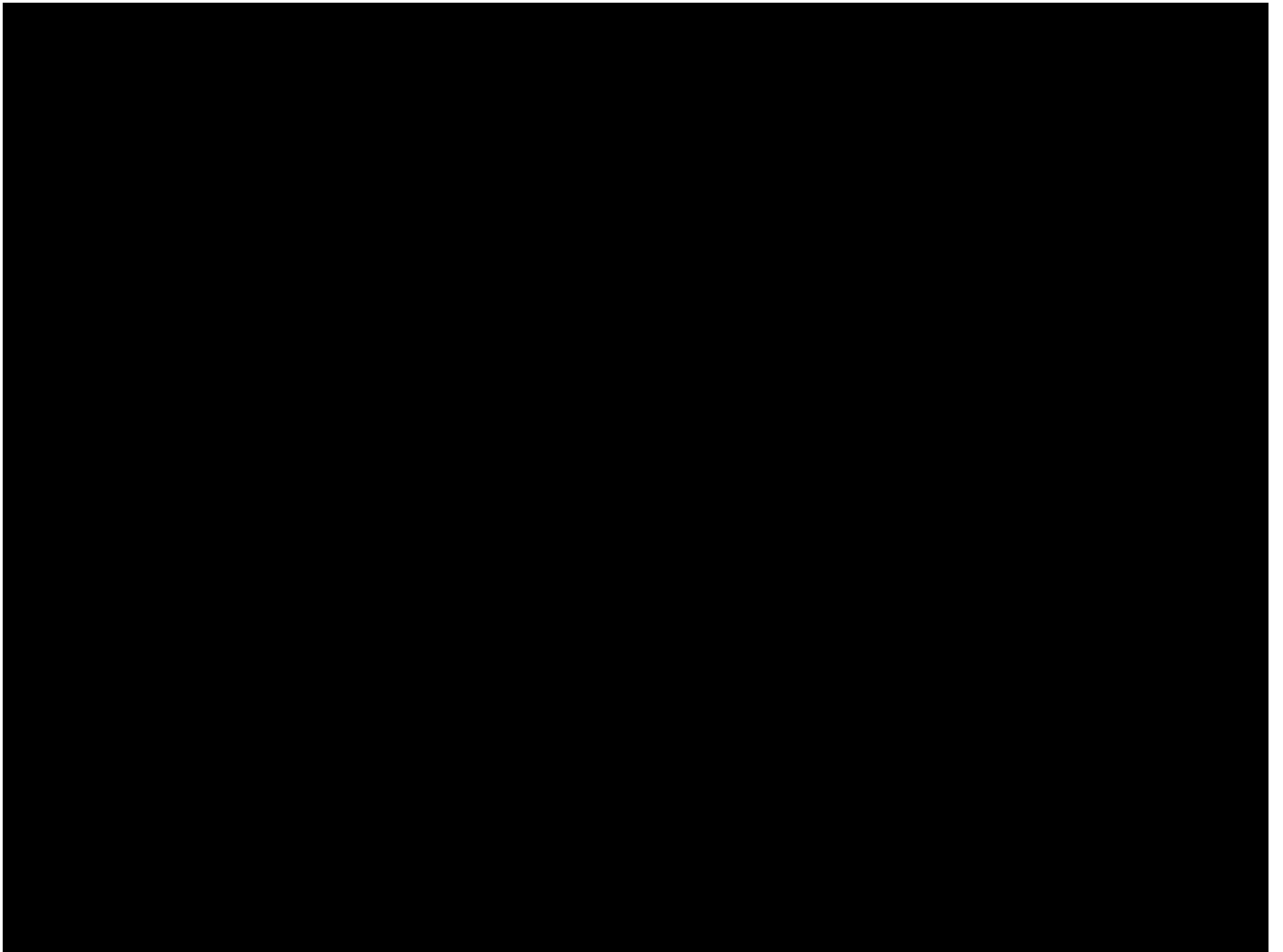
What's needed to restore Lake Huron fish migrations to the Au Sable River?

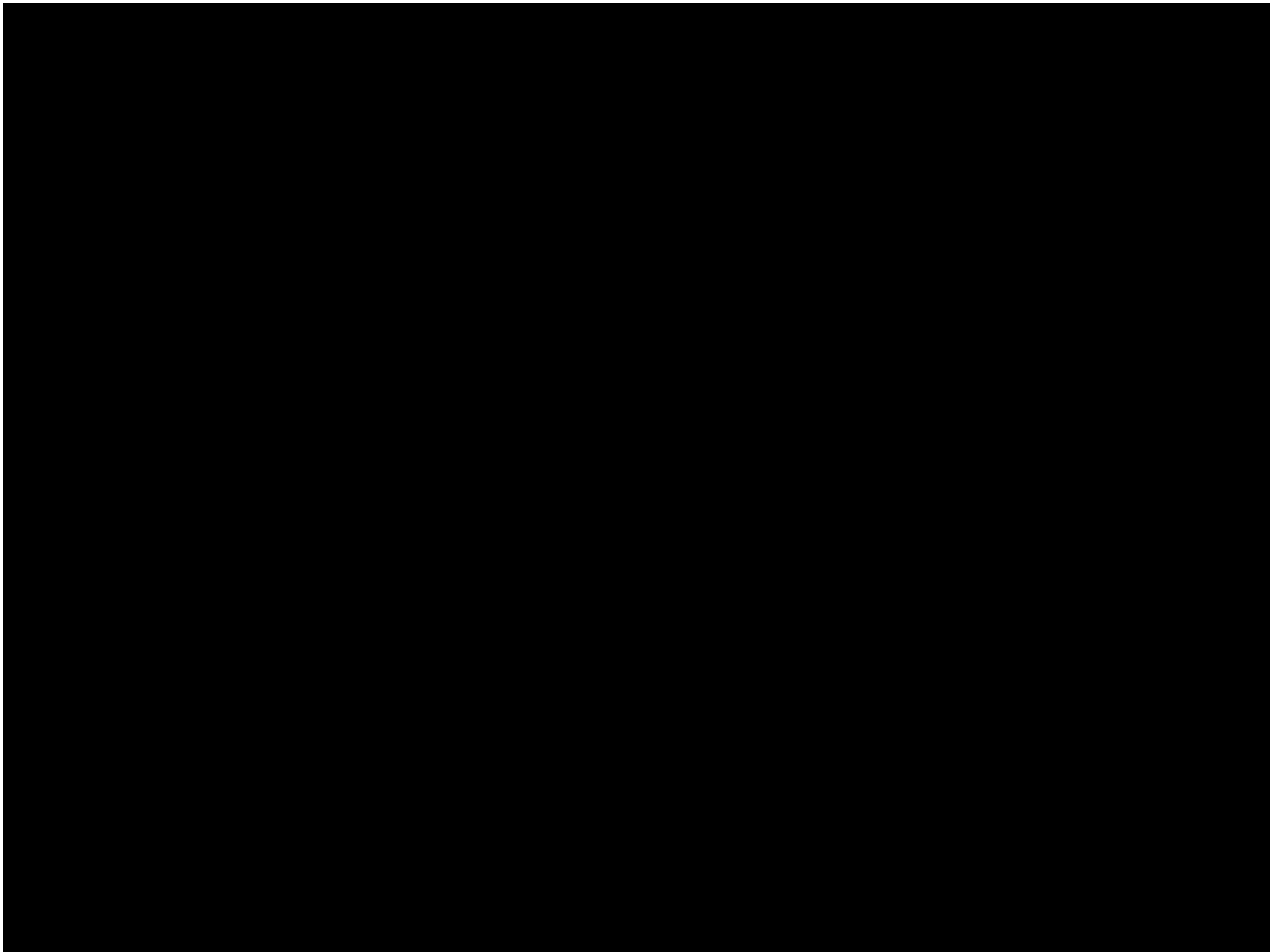
- Cooperation
- Effort
- Compromise
- Flexibility



Conclusions

- Connections between habitats are important for many Lake Huron fishes
- Connections between Lake Huron and its tributaries are very limited
- Tools such as the Lake Huron GIS Project are needed to show problems, identify opportunities, and direct rehabilitation efforts
- We need to foster efforts by others and fully utilize existing opportunities to restore connections between Lake Huron and its tributaries





Lower Peninsula bald eagle productivity

Young fledged per nest

<u>Nest type</u>	<u>1982-6</u>	<u>1987-91</u>	<u>1992-6</u>
Inland	1.14	1.12	1.20
Anadromous	0.27	1.13	0.97
Great Lakes	0.00	0.56	0.80

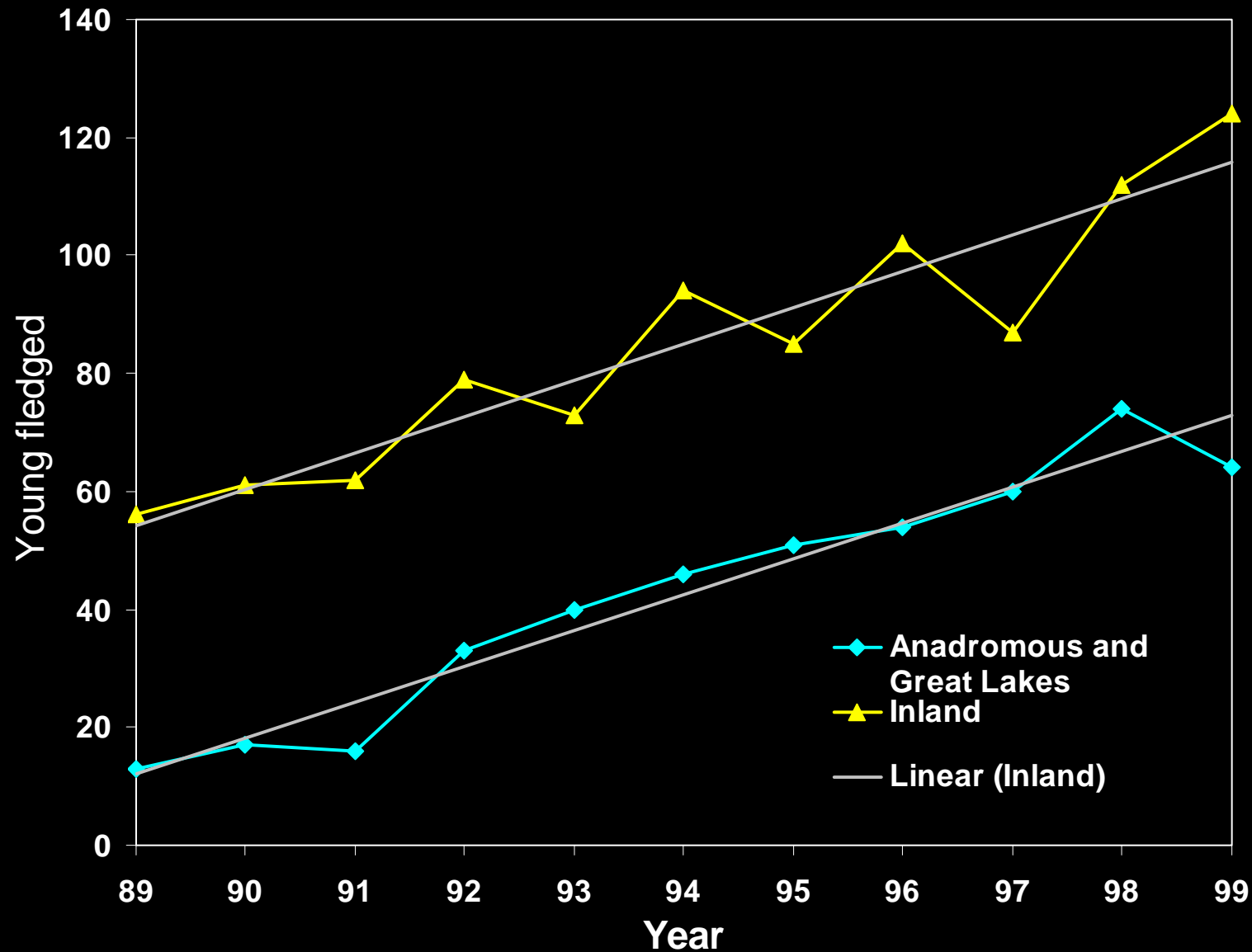
0.7 = Stable and 1.0 = Healthy (Kubiak and Best 1991)

Estimated potential production of three Lake Huron fishes in the Au Sable River between Mio and Foote dams

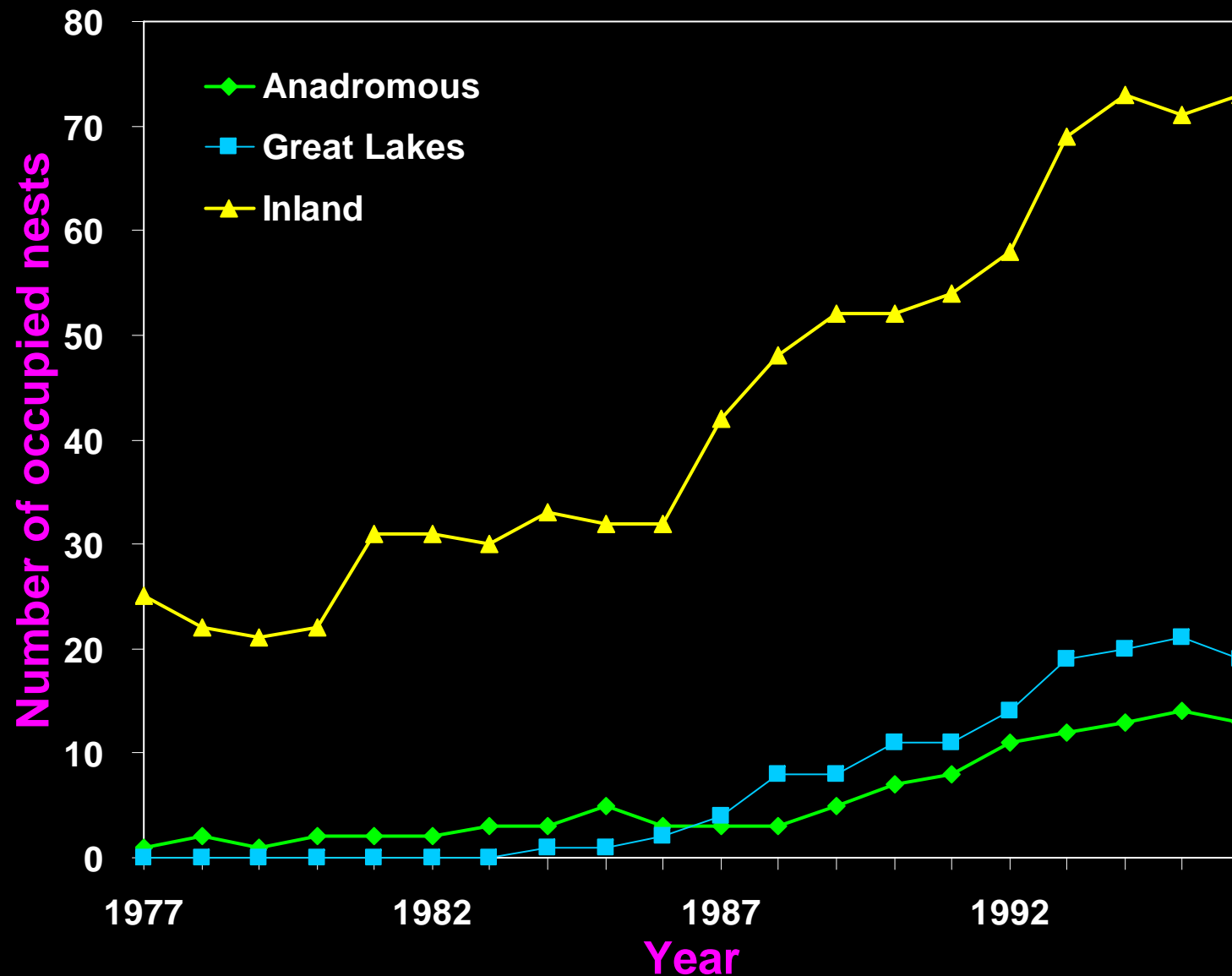
Water type	Adult lake sturgeon run	June YOY chinook	Sept. YOY steelhead
Free-flowing	14,440	10,380,000	290,900
Impounded	19,760	9,230,000	258,600
TOTALS	34,200	19,610,000	549,500

- Whelan estimated >5 ft/mi gradient on a 1000+ cfs river would support adult lake sturgeon runs of 1900 fish per mile (Thuemler 1985; Auer 1995; Auer 1996).
- Estimated production from a 4.6 ft/mi gradient reach on Manistee River was 887,000 June YOY chinook salmon and 24,800 September YOY steelhead per mile (Rutherford et al. 1997)

Bald eagles fledged from inland and anadromous and Great Lakes nests in the Lower Peninsula



Number of occupied bald eagle nests in the Lower Peninsula



Potamodromous fishery of the Au Sable River

- Occurs in 10 of 152 miles of the river's mainstem

In 1987:

- 33,599 angler days spent
- >12,600 Great Lakes salmonids harvested
- Estimated value of \$1,814,000

Estimated annual value of resident trout and potamodromous fisheries between Mio and Foote dams

Potamodromous fishery

- 82.8 miles x 3,168 angler days per mile x \$54 per angler day = \$14,164,762 **Conservative estimate = \$5 million**

Resident trout fishery

- 82.8 miles x 685 angler days per mile x \$54 per angler day = \$3,062,772 **Conservative estimate = \$2 million**

Conservative total = \$7 million

Economics with and without dams

Annual values in millions of dollars

Without dams

<u>Fishery</u>	<u>Value</u>
Potamodromous	\$5.0
Resident trout	<u>\$2.0</u>
	\$7.0

Plus:

Less hatchery cost

With hydroelectric projects

<u>Item</u>	<u>Value</u>
Property taxes	\$0.8
Park revenues	\$0.6
Employee wages	<u>\$0.4</u>
	\$1.8

Plus:

Present fisheries **??**

Taxable (?) profit **\$6.9**

Dams on the Lower Au Sable River:

- Inundate rare, very-high gradient habitats
- Disrupt sediment and woody debris transport
- Increase summer temperatures and prevent night-time cooling
- Reduce aquatic insect diversity and density
- Produce marginally productive, cool ponds
- Reduce populations of coldwater fishes
- Block fish migrations
- Eliminate/impair natural reproduction of coldwater fishes
- Affect human use of the river